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**NOTE ON MESOZOIC MAMMALIA.**

BY O. C. MARSH.

I have recently received from Prof. H. F. Osborn a pamphlet entitled "A Review of the Cretaceous Mammalia," which is intended as a criticism on two of my papers, and is the latest addition to his publications on Mesozoic mammals. This review contains no new facts, and is mainly an application of the author's theories, which may in part prove to be true, but at present are without substantial basis. To attempt to refute all the assumptions he makes would involve a long discussion of known Mesozoic mammals, and take time from more important work. A brief notice of a few points, therefore, must suffice for the present.

The author of this review has never collected any Mesozoic mammals, has no specimens of the kind, and has only seen a part of those belonging to others, who have shown them to him as a matter of courtesy, in some cases even when an investigation was intended or in progress. Of more than a thousand specimens of Cretaceous mammals on which my investigations are based, he has not seen a single one, and no others are known except a few fragments. Of several hundred specimens of Jurassic mammals which I have secured in the West, he has seen perhaps one-tenth, while of other Mesozoic mammals from this country, he cannot have seen in all more than a half dozen specimens.

Prof. Osborn's qualifications for discussing Cretaceous mammals may be fairly judged from his papers on other Mesozoic mammals. One or two examples will make this evident.

He began this work, in 1886, by describing two specimens of *Dromatherium* Emmons, and making a new genus of one of them, on insufficient grounds. He criticised Emmons' work, especially one figure, but this he subsequently modified. His own figures of one of these fossils agree neither with each other nor with the specimen, as a recent comparison shows.

He next turned his attention to the Mesozoic mammals in the British Museum, beginning with *Tritylodon*, described and figured by Owen. Again Prof. Osborn did not agree with the original authority, but announced that a point of "remarkable interest"

had not been appreciated by Owen, namely, a large parietal foramen, showing that "the primitive Mammalia, of this family at least, had a pineal eye of some functional size and value," which fact "adds to the rapidly accumulating evidence for the reptilian ancestry of the mammals." A reference to the specimen itself proved that there was no foundation for the announcement, and Prof. Osborn has since in part corrected it. (Science, vol. ix, pp. 92, 114 and 538, 1887.)

The results of Prof. Osborn's further study of the Mesozoic mammals in the British Museum were not considered important by some of the best authorities there, and some of his observations they disproved, in my presence, by referring to the fossils themselves. His figures of these specimens, moreover, are not accurate, and in some cases are misleading, as a single example will show. In his Mesozoic Mammalia, Plate VIII, he gives a new figure of the type of *Phascolotherium*, but a comparison with the original specimen shows that this figure is erroneous in at least four important points; namely, the first incisor; the crown of the last molar, which is wanting in the specimen; the positions of the dental foramen and of the mylohyoid groove. His method of regarding different isolated specimens as identical, and making a "composite" drawing of them as representing a single type, has led him into serious errors. This method, which belongs rather to metaphysics than to natural science, Prof. Osborn has again used in the present review, and with no better results.

This long review purports to discuss my first and second papers on Cretaceous mammals. The first thing that strikes the careful reader is the title he gives to these papers. My own title was a simple one, "Discovery of Cretaceous Mammalia," and it is only fair to expect, in an elaborate review, that the title, at least, will be correctly quoted. Instead of this, Prof. Osborn has added two other words, giving it a different meaning and quoting it as:—"The Discovery of the Cretaceous Mammalia." He read this review in no less than three different cities, and published an abstract elsewhere, yet apparently had no time to read my title of four words carefully enough to quote it correctly. A small matter, perhaps, but proof positive of careless work.

The next point to be noticed is, that my order *Allotheria* is rejected as not having been defined, and a later term, *Multituberculata*, is adopted because it has been defined. This direct statement of Prof.

Osborn is incorrect, as my order was defined when proposed in 1880 (Am. Jour. Sci., vol. xx, p. 239). The cumbersome term, *Multituberculata*, was not defined when proposed by Cope in 1884, but Prof. Osborn kindly attempted this in 1888. His definition, unfortunately, does not include some characteristic forms of the group, but takes in accurately the genus *Mastodon*, although this great Proboscidian can hardly be considered a Marsupial.

By way of instruction, Prof. Osborn indicates what he terms "the main characters of the dentition of the Mesozoic mammals in general, and some characters which enable us to distinguish between the teeth of mammals and those of reptiles and fishes." This is a most promising statement, but loses some of its force when we find that it has not saved him from precisely these mistakes, either in his previous papers or in the present review, as I show later.

He is scarcely more fortunate in his announcement of what he regards as the well-known characters of the teeth of one group, the *Allotheria*. I have probably seen all the Mesozoic mammals examined by Prof. Osborn in Europe, and likewise quite a number of others, including the type of *Stereognathus*. He is certainly wrong in several of his main conclusions, and in others there are many facts against him.

A more correct restatement of some of the characters of this group would be as follows:

(1.) No true *Plagiaulacidae* are known with three rows of tubercles on the upper molars.

(2.) No *Allotheria* are known with certainty to have three rows of tubercles on the lower molars.

A careful study, moreover, of the known specimens of the true *Plagiaulacidae* would have shown him the strong probability, at least, that the genus *Bolodon*, which he makes the type of a distinct family, is based on the upper jaws of *Plagiaulax*; also, the probability, as I have before suggested, that the type of *Stereognathus*, of which he makes another of his numerous families, is an upper jaw, although described as a lower one.

Bearing in mind these points, Prof. Osborn's main criticisms are seen to be without foundation, and the errors largely his own. By substituting theory for the actual study of well-preserved specimens, he has placed on record the fact that he seems unable to tell upper from lower teeth in Mesozoic mammals, or the teeth of reptiles and fishes from those of mammals.

There is now conclusive evidence that the Cretaceous molar teeth with three rows of crescents belong to the upper series, as I described them. Prof. Osborn's reference of these to the lower jaw is based merely on theory with only conjecture to support it. The same fundamental error runs through most of his review, and measures the value of his criticism.

Another unfortunate error of Prof. Osborn was mistaking the tooth of a Cretaceous reptile for a premolar of a mammal, and not only describing and figuring it as such, but making this a basis for using, even in this review, a generic name (*Meniscoëssus*) against well-known laws of nomenclature. This supposed premolar he figured and described in his *Mesozoic Mammalia*, p. 218, and has elsewhere strongly defended its mammalian character. There is not a particle of evidence of this, as every one familiar with similar specimens knows.

Notwithstanding this mistake, Prof. Osborn ventures to assert in this review, that a tooth which I described and figured as a molar of a mammal, *Stagodon*, has but a single fang, does "not resemble the teeth of any known mammal," and that the genus was "founded upon reptilian or ichthyopsidan teeth." I distinctly stated that this tooth has two fangs, and the bases of these were indicated in one of my figures. Moreover, several well-preserved specimens, since obtained, show two distinct roots and other features which prove these teeth mammalian beyond doubt.

In his *Mesozoic Mammalia*, p. 221, Prof. Osborn describes and figures as a premolar a specimen which is now almost certainly known to pertain to a fish, and not to a mammal. I have a very similar specimen from the same locality, which is pronounced the same species by those who have examined both. This I purchased many years ago of a well-known collector in Stuttgart, who called it a mammal tooth. When investigating Mesozoic mammals later, I examined this specimen with care, and found it to be made up of two portions of fish teeth (*Hybodus*) neatly cemented together, making four cones on a quadrate base, as in the fossil Prof. Osborn described. A friend who saw my specimen has since sent me from Europe drawings of a third supposed mammal tooth from the same locality (Diegerloch), which he considers the same as mine. The drawings are characteristic, and indicate another specimen of apparently the same sort. Others are probably in existence, as the

demand for Mesozoic mammals is great, and the supply has hitherto been limited.

One or two points more should be mentioned about Prof. Osborn's work on Mesozoic mammals; namely, his replacing, on insufficient grounds, scientific names, especially those of families and genera, by other names of his own; also, using the figures of other authors without the usual credit. As an example of the latter, I may cite this use of no less than five of my figures of Jurassic mammals, in his memoir on Mesozoic Mammalia.

Prof. Osborn in his review alludes to "the extremely complex and confusing dentition" of some Mesozoic mammals, and of the truth of this statement his own papers afford many illustrations besides those here mentioned. What this perplexing subject really needs, however, is more facts and less theory. Believing this, I have endeavored to secure new facts by long and laborious explorations, hoping in this way to clear up some of the confusion which so puzzles fireside naturalists. The 1,500 specimens of Mesozoic mammals I have thus secured, fragmentary though most of them are, will, I trust, prove of some service in this work, although their full investigation has been delayed by other duties.

No one who has earnest work to do can afford to spend time in the ungracious task of pointing out errors in the work of others. For this reason I have hitherto said nothing about Prof. Osborn's papers on Mesozoic mammals, intending to wait until my own memoir, for which I have collected so much material, should make it my duty to review the whole subject. The injustice of his criticism on my preliminary work while in progress made a brief reply necessary; the full discussion, I must still reserve for my memoir.